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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 2030383PC/or	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/FI2004/000215	International filing date (day/month/year) 07-04-2004	Priority date (day/month/year) 11-04-2003
International Patent Classification (IPC) or national classification and IPC H04Q 7/34 H0 7/32		
Applicant Nokia Corporation et al		

- This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 3 sheets, including this cover sheet.
- This report is also accompanied by ANNEXES, comprising:
 - ☒ (sent to the applicant and to the International Bureau) a total of 5 sheets, as follows:
 - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

- This report contains indications relating to the following items:

<input checked="" type="checkbox"/>	Box No. I	Basis of the report
<input type="checkbox"/>	Box No. II	Priority
<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/>	Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/>	Box No. VI	Certain documents cited
<input type="checkbox"/>	Box No. VII	Certain defects in the international application
<input type="checkbox"/>	Box No. VIII	Certain observations on the international application

Date of submission of the demand 01-11-2004	Date of completion of this report 23-06-2005
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI2004/000215

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1(b))
☐ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

☐ the international application as originally filed/furnished

☒ the description:

pages 1, 3-13 as originally filed/furnished

pages* 2 received by this Authority on 01-03-2005

pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 14-17 received by this Authority on 01-11-2004

pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-4 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing (*specify*): _____
☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing (*specify*): _____
☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI2004/000215

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-20</u>	YES
	Claims	_____	NO
Inventive step (IS)	Claims	<u>1-20</u>	YES
	Claims	_____	NO
Industrial applicability (IA)	Claims	<u>1-20</u>	YES
	Claims	_____	NO

2. Citations and explanations (Rule 70.7)

The invention relates to a method for testing a peripheral device in a mobile station. A test signal generator and a measurement unit for measuring an electric quantity from a feeding line of the device under test are integrated into the mobile station.

Documents cited in the International Search Report:

D1: US 6118982 A

D2: EP 0825734 A

D3: EP 0759680 A

D4: US 5481186 A

D5: "Economics of diagnosis" Ambler A. P. et al. 1997 AUTOTESTCON PROCEEDINGS Anaheim Ca. USA AUTOTESTCON Sep.22-25 1997

D6: "Built-In Self-Test" Zorian Y. Microelectronic Engineering, Elsevier Publishers BV., Amsterdam, NL. Vol.49, no.1-2 November 1999

D1 reveals a method for automatically monitoring a mobile telephone, (abstract). D2 discloses a self-testing transceiver which might be a mobile telephone, where an accurate reception of a test signal indicates proper operation, (col.2 lines 4-8; col.4 lines 29-34; claim 1).

D3 deals with a mobile telephone that tests its headset, while D4 describes the testing of circuits in a mobile telephone. D5 and D6 describe self-tests.

D1-D5 fail to reveal that an electric response of the test object is determined and that the electric quantity is measured from the feeding line that is used to feed the electric test signal, and not from the output of the device being tested. Thus, the claimed invention fulfils the requirements of novelty, inventive step and industrial applicability.

According to another aspect of the invention, there is provided an arrangement for testing a device of a mobile station, comprising: a signal generator for generating an electric test signal for testing a device; a feeding line connected to the signal generator and the device for feeding the electric test signal to the device; and the mobile station further comprises a measurement unit connected to the feeding line for measuring an electric quantity from the feeding line; the arrangement further comprises an analyser connected to the measurement unit for determining an electric response of the device to the electric test signal based on the electric quantity; and at least a portion of a testing arrangement is integrated into the mobile station, the testing arrangement comprising the signal generator and the analyser.

Preferred embodiments of the invention are described in the dependent claims.

The method and system of the invention provide several advantages. In an aspect, the invention reduces the need for external test equipment, thus decreasing the cost of a test line, simplifying the testing procedure and increasing the output and reliability of a test line in mass production of mobile stations.

List of drawings

In the following, the invention will be described in greater detail with reference to the preferred embodiments and the accompanying drawings, in which

Figure 1 shows an example of the structure of a mobile station by means of a block diagram,

Figure 2 shows an example of an arrangement for testing a device of a mobile station by means of a block diagram;

Figure 3 shows an example of an arrangement for testing an audio device of a mobile station, and

Figure 4 shows a flow chart illustrating embodiments of the invention.

Description of embodiments

Figure 1 shows an example of the structure of a mobile station 100 by means of a block diagram. The mobile station 100 comprises a base band part (BB) 104 and a radio frequency part (RF) 102 placed, for example, on a printed circuit board 120.

Claims (Amended 21 October 2004)

1. A method of testing a device of a mobile station, the method comprising:

5 generating (402) an electric test signal for testing a device; and
 feeding (404) the electric test signal to the device by a feeding line;
 c h a r a c t e r i z e d b y
 measuring (408) an electric quantity from the feeding line by a
 measurement unit integrated into the mobile station;
 determining (410) an electric response of the device to the electric
10 test signal based on the electric quantity; and
 performing at least a portion of the testing procedure by using a
 functional unit integrated into the mobile station, the testing procedure comprising generating the electric test signal and determining the electric response of the device.

15 2. The method according to any one of the preceding claims,
 c h a r a c t e r i z e d b y evaluating (412) performance of the device based on
 the electric response.

 3. The method according to any one of the preceding claims,
 c h a r a c t e r i z e d b y connecting (406) the measurement unit to the feeding
20 line.

 4. The method according to any one of the preceding claims,
 c h a r a c t e r i z e d b y generating (402) the electric test signal by a signal
 generator integrated at least partially into the mobile station.

 5. The method according to any one of the preceding claims,
25 c h a r a c t e r i z e d b y determining (410) the electric response of the device
 to the electric test signal by an analyser integrated at least partially into the
 mobile station.

 6. The method according to any one of the preceding claims,
 c h a r a c t e r i z e d b y measuring (408) the voltage of the electric test signal
30 over the device; and

 determining (410) the electric response of the device to the electric
 test signal, based on the voltage.

 7. The method according to any one of the preceding claims,
 c h a r a c t e r i z e d b y generating (402) a predefined electric test signal for
35 testing a device with a known electric response to the predefined electric test
 signal; and

evaluating (412) performance of the device based on the known electric response and the electric response of the device to the electric test signal.

8. The method according to any one of the preceding claims,
5 c h a r a c t e r i z e d by measuring (408) the electric quantity by a measurement unit with an input impedance chosen such that the accuracy of the electric response of the device to the electric test signal is above a predefined value.

9. The method according to any one of the preceding claims,
10 c h a r a c t e r i z e d by connecting (406) a measurement unit measuring the electric quantity to a feeding line of a device of plurality of devices; and
measuring (408) the electric quantity from a feeding line of a device of plurality of devices.

10. The method according to any one of the preceding claims,
15 c h a r a c t e r i z e d in that the device is a peripheral device.

11. An arrangement for testing a device of a mobile station, comprising:

a signal generator (230) for generating an electric test signal for testing a device (200, 202, 204);

20 a feeding line (210, 212, 214) connected to the signal generator (230) and the device (200, 202, 204) for feeding the electric test signal to the device (200, 202, 204);

c h a r a c t e r i z e d in that

25 the mobile station further comprises a measurement unit (240) connected to the feeding line (210, 212, 214) for measuring an electric quantity from the feeding line (210, 212, 214);

the arrangement further comprises an analyser (260) connected to the measurement unit (240) for determining an electric response of the device (200, 202, 204) to the electric test signal based on the electric quantity; and

30 at least a portion of a testing arrangement is integrated into the mobile station, the testing arrangement comprising the signal generator (230) and the analyser (260).

12. The arrangement according to claim 11, c h a r a c t e r i z e d in that the arrangement further comprises an evaluating unit (270) connected to
35 the analyser (260) for evaluating performance of the device (200, 202, 204) based on the electric response.

13. The arrangement according to any of the preceding claims 11-12, characterized in that the mobile station comprises a switching unit (240) for connecting the measurement unit (240) to the feeding line (210, 212, 214).

5 14. The arrangement according to any of the preceding claims 11-13, characterized in that at least a portion of the signal generator (230) is integrated into the mobile station.

15 15. The arrangement according to any of the preceding claims 11-14, characterized in that at least a portion of the analyser (260) is integrated into the mobile station.

16 16. The arrangement according to any of the preceding claims 11-15, characterized in that the measurement unit (250) is configured to measure voltage of the electric test signal over the device (200, 202, 204); and the analyser (260) is configured to determine the electric response of the device (200, 202, 204) to the electric test signal, based on the voltage.

17 17. The arrangement according to any of the preceding claims 11-16, characterized in that the signal generator (230) is configured to generate a predefined electric test signal for testing a device (200, 202, 204) with a known electric response to the predefined electric test signal; and
20 the evaluating unit (270) is configured to evaluate performance of the device (200, 202, 204) based on the known electric response and the electric response of the device (200, 202, 204) to the electric test signal.

25 18. The arrangement according to any of the preceding claims 11-17, characterized in that an input impedance of the measurement unit (250) is chosen such that the accuracy of the electric response of the device (200, 202, 204) to the electric test signal is above a predefined value.

19. The arrangement according to any of the preceding claims 11-18, characterized in that the mobile station comprises a plurality of devices (200, 202, 204) with a plurality of feeding lines (210, 212, 214);

30 the mobile station comprises a switching unit (240) for connecting the measurement unit (250) to the feeding line (210, 212, 214) of the device (200, 202, 204) of a plurality of devices (200, 202, 204) one at a time; and

the measurement unit (250) is configured to measure the electric quantity from the feeding line (210, 212, 214) of the device (200, 202, 204)
35 from a plurality of devices (200, 202, 204).

20. The arrangement according to any of the preceding claims 11-19, characterized in that the device (210, 212, 214) is a peripheral device (130-156).